Emergence and orchestration of service ecosystems to support agricultural innovations: drivers and models in Sub Saharan Africa

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Résumé :

Les Ecosystèmes de Services Support à l'Innovation sont des outils essentiels pour accélérer les innovations en agriculture et contribuer à répondre aux Grands Défis (Grand Challenges) pour atteindre les ODD. Approfondir notre compréhension des moteurs et des modèles d'émergence des écosystèmes de services est nécessaire pour améliorer leur efficacité. Notre recherche s'appuie sur les cadres théoriques des écosystèmes de services, de l'alignement et de l'émergence dans différents secteurs d'activité. En tenant compte des spécificités de l'innovation dans le secteur agricole, nous proposons de nouvelles perspectives sur l'émergence des écosystèmes de services à travers l'évolution du rôle de l'organisation hub tout au long du parcours de l'innovation.

Nous avons adopté une approche abductive ancrée dans plus de cinq ans de données d'études de cas concernant un label innovant d'agriculture biologique en Afrique subsaharienne

(innovations techniques, sociales et organisationnelles mobilisant plusieurs services d'appui à l'innovation).
Nous avons identifié trois phases d'émergence avec plusieurs conditions préalables nécessaires, deux modèles d'émergence différents liés à la nature de l'organisation hub et deux moteurs clés conditionnant l'émergence.

Mots-clés : Services Support à l'Innovation ; Ecosystèmes de Services ; Emergence ; Systèmes Participatifs de Garantie ; alignement inter-organisationnel

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Abstract:

Ecosystems of Innovation Support Services appear as critical tools to accelerate innovations in agriculture and contribute to responding to the Grand Challenges for achieving the SDGs. Deepening our understanding of the drivers and models of service ecosystems' emergence is needed to improve their efficiency. Our research builds on theoretical frameworks of service ecosystems, alignment, and emergence in different activity sectors. Considering the specificities of innovation in the agricultural sector, we propose new insights on service ecosystems' emergence through the evolving role of the hub organization along the innovation journey.
We took an abductive approach anchored in over 5 years of case study data regarding innovative labelling of organic farming in Sub-Saharan Africa (technical, social, and organizational innovations mobilizing several innovation support services).
We identified three phases of emergence with several necessary preconditions, two different emergence models related to the nature of the hub organisation and two key drivers conditioning emergence.

Keywords: Innovation Support Services; Service Ecosystems; Emergence; Participatory Guarantee Systems; inter-organisational alignment

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1. INTRODUCTION

The world, particularly countries in the Global South, grapple with what scholars term Grand Challenges - complex but identifiable problems profoundly affecting a large number of individuals (Eisenhardt et al., 2016; Ferraro et al., 2015; George et al., 2016). Solutions to these challenges are elusive but are likely to require interdisciplinary approaches and coordinated efforts. The agricultural sector intersects with several Grand Challenges, including food security, poverty alleviation, climate change mitigation, and addressing negative consequences of the Green Revolution. The necessity of an ecological transition is largely shared between actors, and international donors advocate and finance initiatives towards this goal.

In this process, organic labels are seen as one of the means able to pull a variety of innovations contributing to the transformation of food systems toward more sustainability. Participatory Guarantee Systems are national labels allowing to certify agricultural products for local markets, based on a standard defined collectively by local stakeholders (producers, retailers, consumers, etc.). This kind of organic label is a systemic innovation requiring several changes in the agricultural production systems (organic agriculture, bio-inputs, agroforestry, permaculture), in the farm functioning, in organisational structuration (implementation of cooperatives, associations, etc.), value chains (new trading modes), new financing modalities, etc. All these innovations require support to facilitate their emergence and acceleration. This

support takes the form of Innovation Support Services as varied as knowledge transfer, intermediation, access to resources, etc. (Faure et al., 2019; Mathé et al., 2016; Toillier et al., 2021).

The World Bank classifies countries based on income levels into Low-income (LIC), Lower-middle income (LMIC), Upper-middle income (UMIC), and High-income (HIC) categories. Innovation support differ significantly between LIC/LMIC and UMIC/HIC, influenced by their historical contexts. Structural adjustment programmes in the 1980s-90s prompted many Latin American, African, and Asian countries to slash spending on farm advisory services, deeming them ineffective (Faure et al., 2014), resulting in diminished support for farmers and the privatization of agricultural advice. However, privatization has drawbacks, including prioritizing profitable services (e.g., technology transfer over capability enhancement) and providing better support for profitable exports value chains (Faure et al., 2014; Kidd et al., 2000; Klerkx et al., 2006; Labarthe, 2005). Consequently, a decrease is observed in these countries of scientific knowledge transfer to farmers and their innovation which is, among others, based on their absorption capacity directly related to their knowledge base (Cohen & Levinthal, 1990; Haudeville & Le Bas, 2018).

The proliferation of actors in this landscape can lead to a cacophony of interventions that hinder progress towards ecological transition. Agroecological transitions are inherently complex, involving multiple stakeholders, disciplines, and challenges. Effective coordination is crucial for fostering knowledge exchange, sharing best practices, and efficiently managing resources across various scales. In this paper we propose to study this coordination in the form of an ecosystem of Innovation Support Services (ISSE): its emergence, development, and perpetuation, to answer to the stakeholders' lack of knowledge on how to enhance their support (FAO, European Commission, AFD, Fert, etc.).

Considering the varying levels of maturity of national Agricultural Innovation Systems (AIS) in countries of the Global South (Lamprinopoulou et al., 2014; Spielman et al., 2009; Suresti et al., 2018), it is presumed that the emergence and development of Innovation Support Service Ecosystems (ISSE) are influenced by the characteristics of these national AIS. This includes factors such as the structural dimension, the degree of alignment among its components, and the composition and orchestration of innovation networks.

The lack of robust networking among research centres and other actors, such as entrepreneurs, firms, and NGOs, is particularly notable (Haudeville & Le Bas, 2018). Coordination issues exacerbate challenges, with missing links between branches, brokers absent in innovation networks, and civil society organizations noticeably absent. Consequently, some actors tend to be extremely close to each other (e.g. farmers to farmers' organisations or farmers' organisations to policy actors) by virtue of being the only available interlocutor. Moreover, certain actors are forced into multiple roles to address functional gaps within these ecosystems (Toillier et al., 2021), such as NGOs providing multifaceted support, from capability enhancement to technical advice and funding solutions (Klerkx et al., 2009). In this context, temporary organizational mechanisms, such as project-based approaches, may be employed to bridge these gaps until formal organizations are established.

In addition to addressing field inquiries, our analysis aims to fill existing literature gaps regarding service ecosystems. While most research on service ecosystems has focused on secondary or tertiary sectors, there remains a notable dearth in understanding the unique characteristics of service ecosystems within the agricultural sector, especially in the Global South, as presented above. As previously mentioned, innovation support in the agricultural sector of the Global South is facilitated by a diverse array of organizations, many of which are non-profit. The literature on Public Service Innovation Networks (PSINs), which concentrate

on non-market (public/social) services, can provide insights into the distinct features of these services.

Desmarchelier et al. (2021) introduce a sub-category within PSINs known as Public Service Innovation Networks for Social Innovation (PSINSIs), which address complex issues necessitating coordinated action. They underscore that social innovation within these networks isn't solely driven by "heroic entrepreneurs" but also by "*consultancies specializing in the accumulation and processing of knowledge, which they place at the disposal of their clients*" (Desmarchelier et al., 2020) which they refer to as KISS (Knowledge-Intensive Social Services). These organizations not only disseminate knowledge but also facilitate connections among social actors, forming extensive social innovation networks. However, the findings regarding KISS are predominantly derived from non-agricultural sectors (e.g., health, environment) in Northern economies, underscoring a knowledge gap in our analytical context. Currently, the bulk of research on ecosystem emergence has predominantly focused on business ecosystems and innovation ecosystems, leaving service ecosystems relatively underexplored and many aspects of service ecosystems remain unexamined. While coordination mechanisms have been extensively studied in firm contexts, Picaud-Bello et al (2022) noted a gap in understanding these mechanisms within ecosystem contexts, that she began to fill in the tourism sector. However, tourism ecosystems typically exhibit high structure and formalized and planned support systems, which contrasts with the agricultural sector in the Global South. Here, support is often decentralized, grassroots-driven, and adapted ad-hoc to the demands of innovators. Consequently, orchestration mechanisms differ significantly, highlighting the need to comprehend how stakeholders align and collaborate towards common objectives.

Addressing Möller et al's (2020) call for deeper research into the collaborative construction and orchestration of ecosystems, this article seeks to explore the role of the hub organisation in this

process. Through a comparative analysis of three service ecosystems, this study aims to bridge these gaps and shed light on the processes and capabilities required for ecosystem orchestration. Our research questions are the following: what are the (pre)conditions of emergence of ISSE and to what extent the level of maturity of the national AIS influences it? Who are the organisations orchestrating the necessary alignment of organisations to allow ISSE's emergence, and how much do they generate specific models of ISSE?

This paper aims to enhance stakeholders' understanding of the emergence and functioning of ISSE. To achieve this, it seeks to leverage existing research on business and service ecosystems in sectors beyond agriculture. By doing so, it intends to deepen insights into service ecosystems within the agricultural sector, specifically concerning ecological transitions. Additionally, the paper aims to identify the conditions under which service ecosystems for agriculture emerge in the Global South.

The remainder of the paper is organised as follows: first we will introduce the conceptual building blocks of our theoretical framework. We begin by presenting how the ecosystem concept is appropriate to describe our study object, then develop the concepts of ecosystem emergence, alignment, and orchestration. In section 2, we will explain the methodology implemented to respond to our research questions. Then we will present our findings rand discuss them before concluding on our theoretical and managerial contributions.

2. THEORETICAL FRAMEWORK

Different theoretical frameworks have been developed in the literature to describe and characterise the different forms of collective organization (networks, meta-organisations, innovation communities, clusters, ecosystems, etc.) and their interrelations. We will not here define each of them but rather explain why we chose to describe our study object through the lens of ecosystems. First, as Vargo & Akaka (2012) underlined, service ecosystems are dynamic and can be understood through their value and value creation which is in line with our

observations. Moreover, our study object complies with the three defining elements of ecosystems according to Thomas et al (2022) allowing to discriminate them from other forms of gatherings of organisations: (i) activities relying on non-hierarchical mechanisms; (ii) generation of relationships between participants allowing them to benefit from the interactions inside the ecosystem; (iii) a value-proposition at ecosystem-level to respond to the needs of a specific audience. The seminal and most referred definition of service ecosystems is due to Vargo & Lusch (2016) and describes these collective organizations as "*a relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange*". Another definition, provided by Simmonds et al (2021), expands the previous on introducing the useful concept of layers in ecosystems: "*The driving principles of the ecosystem concept are interdependence, dynamism and multilayered organization, which collectively underpin a systemic orientation, shifting from static and mechanistic assumptions to a more transcending view of complex wholes, relationships and processes*". However, this concept of layers in service ecosystems pre-existed this definition and was previously mentioned by other authors although they do not agree on the numbers, names, and characteristics of the layers. Some proposed to divide ecosystems in three levels: micro-, meso- and macro-levels (Akaka et al., 2015; Chandler & Vargo, 2011) while others introduced a fourth layer: micro-layer, lower meso-layer, upper meso-layer, macro-layer (Möller et al., 2020). We will here focus our analysis on the upper meso-layer (field-specific norms, rules, laws, and technologies) and the lower meso-layer (actors, role, goals and culture, innovativeness, governance modes, etc.) which we believe are the most influential on service ecosystem's emergence.

Emergence can be defined as the creation of something new (organisations, entities, structures, concepts, etc.) from pre-existing elements (Bhaskar, 2008). In service ecosystems literature, it is crucial to aim attention at this specific phase of the ecosystem life cycle, as it is compulsory

for achieving successful ecosystems and is a valuable way to disentangle the complexity of service ecosystems (Polese et al., 2020). Furthermore, this phase is often difficult to study because of the high rate of failure of these organisational forms, making it difficult to understand the determinants of emergence success or failure and the capabilities mobilised by the actors (Attour & Barbaroux, 2016). Thomas et al (2022) propose a simple, yet comprehensive definition of service ecosystem emergence: "*a collective discovery, sensemaking, and negotiation process through which participants jointly discover and negotiate the elements necessary to establish a functioning ecosystem*". Various authors described ecosystem emergence by splitting it in distinct phases. For example, Thomas (2013) detailed three different phases: initiation (initial idea, resource gathering and first activities), momentum (rapid growth, increased number of participants and competition) and control (legitimacy, stabilisation of power relations, value appropriation). More recently, describing business ecosystems, Möller et al (2020) proposed a slightly different division in three phase: exploration (with visioning, sensemaking, collaborative network learning), mobilisation (forming network through motivation, influencing, forming joint goals and constructing the ecosystem) and stabilisation (consolidating the ecosystem, extending business, institutionalising).

For this emergence of ecosystems to happen, organisations need to engage in the ecosystem, their actions will build the ecosystem and in return the ecosystem will influence their actions; this is what Taillard et al (2016) call actor's agency to explain ecosystem emergence. This emergence will be possible if members manage to align activities, actors, positions, and links (Adner, 2017). The "structuralist approach" considers that ecosystems are resulting from the alignment of organisations in order to materialize a joint value proposition (Adner, 2017; Malherbe & Tellier, 2022). Several elements constrain alignment of organisations, as Malherbe & Tellier (2023) identified in the literature: technology, innovation, value distribution, identity,

power, and public authorities. In the agricultural context in the Global South, introduction of new technological elements is not as relevant as it can be in the cases studied by Malherbe et Tellier. Thus, we propose not to consider it in our analysis. All the other criteria are relevant in our study, some of them more crucial than others. There are multiple and diverse **innovations** (PGS label, new value chains, inputs, agricultural practices, etc.). In our context, part of the ecosystem members are non-profit organisations and thus do not seek to capture monetary value that is created. But other types of **value are created and distributed**: intellectual value (the label, the agricultural inputs "recipes"), social value (improving income and quality of life for farmers and traders). **Identity** can also be called common vision and refers to the representations, norms and shared values of members of the ecosystem which drives ecosystems' actions and contributes to build its legitimacy (Thomas & Ritala, 2022). While being less present in our case than in business ecosystems where position of power can provide competitive advantage, **power** seeking is still an important element to consider. Finally, **public authorities** can create a rather favourable context for ecosystem emergence. However, in countries of the Global South where governments usually lack financial and human resources, **development projects and international donors** sometimes have a greater impact on ecosystems' emergence than public authorities. We will thus include this new constraining factor and consider how it can influence alignment.

Adner (2017) divides ecosystems literature in two distinct, yet mutually consistent conceptualization: (i) ecosystem-as-structure, which he prefers and develops (considering that the focal value proposition is the most decisive factor to explain alignment) and, (ii) ecosystem-as-affiliation focusing more on actors who are defined by their network. We will adopt this view, where alignment is defined this way: "*Over time, [the member organisms] coevolve their capabilities and roles, and tend to align themselves with the direction set by one or more central companies*." (Moore, 1996). The involvement of a central actor to orchestrate the significant

challenges posed by the competitive, collaborative and co-evolutionary aspects of relationships in an ecosystem (Picaud-Bello et al., 2022), is congruent with both our observations and several research streams. However, this central actor bore different names in the literature: "*hub firm orchestrating the network*" (Dhanaraj & Parkhe, 2006), "*catalysing agent*" (Ekboir & Cruz, 2012), "*lead organisation*" (Popp et al., 2014) in network literature; "*central actor*" (Gulati et al., 2012) or "*focal firms*" (Valente & Oliver, 2018) in meta-organisations literature, "*Leader firm*" (Grab, 2017) in innovation communities and "*ecosystem leaders*" (Moore, 1993), "*keystones*" (Iansiti & Levien, 2004) or "*Generic actor*" (Ekman et al., 2016) in ecosystem literature. The key role of this organisation is to orchestrate the ecosystem which can mean

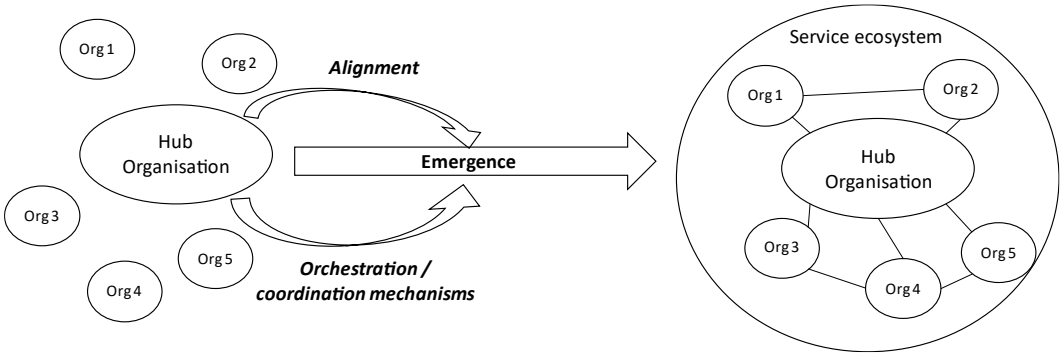

Figure 1: Theoretical framework to study how the hub organisation contributes to emergence of service ecosystems through alignment of members and orchestration

bringing the ecosystems' partners "*into the positions and roles that its ecosystem strategy envision*" (Adner, 2017). It encompasses several kinds of roles and activities: selecting members of the ecosystem, facilitating their interactions, mediating potential conflicts, exercising leadership, formulating common vision and missions, structuring and defining members' roles, facilitating knowledge creation and sharing, representing the ecosystem towards donors and government, etc. (Adner, 2017; Berthet & Hickey, 2018; Bodin & Crona, 2009; Favre-Bonté et al., 2016; Isaac et al., 2007; Keast & Hampson, 2007). Thus, focusing on alignment and orchestration, we will study how the hub organisation allows the emergence of a service ecosystem (cf Figure 1).

3. METHODOLOGY

To identify similar patterns in the emergence of innovation support services ecosystems, we conducted a cumulative study based on three case studies depicting the creation of organic or agroecological PGS (Participatory Guarantee Systems) in three countries of Sub-Saharan Africa (Burkina Faso, Senegal, and Madagascar). As Garreau (2020) indicated, cumulative multiple case studies allow to propose a generic model, of the situation depicted in the cases and is particularly adapted to describe processes. We decided to have three case studies because we intuitively thought that there would be different characteristics to observe at different stage of the ISSE emergence. Thus, we looked for cases where the innovation topic is similar (PGS as a new label in the context of each country), but where both contexts (different countries) and stages of implementation were different. Indeed, the innovation initiative in Burkina Faso and Senegal started several years ago, whereas in Madagascar implementation of PGS can be considered as still in its infancy allowing to see *de visu*, the emergence of the ecosystem. This cumulative analysis will allow us to observe the different stages of the process of emergence. Moreover, we will also conduct a comparative analysis on the first phases of emergence as we will gather historical information from all case studies (phase one is described for all three case studies, phase two for two of the case studies and phase three for only one case study).

3.1. DATA COLLECTION

Our data was collected from several sources including semi-structured interviews with key stakeholders and secondary data (activity reports, master thesis, websites, documentation from projects either provided by the stakeholders or through a documentary research). This triangulation both allowed us to reduce the biases of each data source and offers additional information of the social phenomenon we want to describe (Mathison, 1988). Semi-structured interviews were chosen as they allow to grasp diverse information on a new subject, deepen emergent and interesting themes during the interview, and collect in-depth information to

explain social processes (Mason, 1996; Möller et al., 2020). Interviews were conducted between May 2022 and December 2023; this extended period of data gathering is due to our willing to follow the on-going process in the case study in Madagascar by updating information through a second round of interviews with similar stakeholders. The interview guide was structured in two main themes: first the history and trajectory of emergence of the ecosystem which supported the implementation of PGS, and second the details of how the ecosystem work, its governance, collaboration, and competition existing between members, activities carried out together, etc.

Both snowball sampling (Eide, 2008) and purposive sampling (Palys, 2008) were used. Snowball sampling consisted in asking the first respondents the names and details of the next interesting persons to interview. This method is particularly relevant in our situation because we wanted to interview people who are involved in the same ecosystem and who are in relation with each other. Moreover, we started the interviews with the actor that we thought was the most central in the ecosystem and supposedly knowing all the other actors of the ecosystem. But we triangulated this information with purposive sampling which allowed us to identify from other sources (reports, websites, etc.) more relevant actors to interview. Our sampling was not meant to be exhaustive but rather to collect the vision of the main actors and types of actors involved (NGOs, donors, civil society, producer organisations, development projects, research institutes, etc.) (see Table 1, codes will be referred to, further in the document when verbatim are cited). However, some organisations were more difficult to reach due to their limited access and expertise in digital tools (some producer organisations) and due to security reasons, we couldn't go to meet them in person. We stopped the interviews when reaching theoretical saturation which meant either that we interviewed all the organisations of the core of the ecosystems (the ones tightly linked to each other), or that no more new information was collected during interviews.

		Burkina Faso	Senegal	Madagascar
Primary data	**National NGO**	BF_NatNGO	SEN_ NatNGO	0
	Private enterprise	BF_Priv1	0	0
	International NGO	BF_IntNGO	SEN_IntNGO	MAD_IntNGO
	Technical consultant	BF_Cons1 and BF_Cons2	SEN_Cons	0
	Association	BF_Asso1	0	0
	Producer Organisation	0	SEN_PO1 and SEN_PO2	MAD_PO1 and MAD_PO2
	Donor	0	SEN-Don	MAD-Don
	Ministry of Agriculture	0	0	MAD-Min
Secondary Data	**Project reports**	12	7	8
	Master's thesis	5	0	0
	Communication document	2	0	1
	Internal document	4	2	1
	Law	1	1	1

Table 1: Data collected and codes for the interviews conducted for each case study.

Interviews were fully transcribed and following Braun & Clarke (2006) adapted to management research by Linde et al. (2021), we conducted a thematic coding of the transcribed data and secondary data collected. Thematic analysis is a valuable approach for uncovering patterns and connections within large and intricate datasets. It involves an iterative process of reading, interpreting and reconceptualizing the interviews to identify themes, ultimately leading to the development of an empirically grounded framework from qualitative data (Braun & Clarke, 2006). The analysis was facilitated by the Nvivo14 software. In total we identified 17 codes that we were able to group into 8 sub-themes and 3 Themes which represent the data structure presented in

Figure 2.

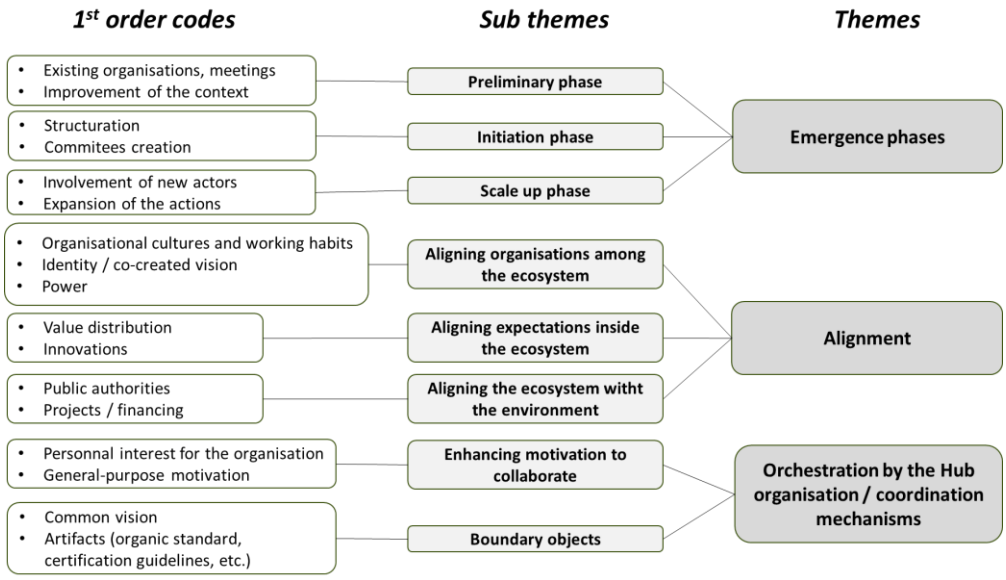

Figure 2: Data structure

3.2. CASE STUDIES

In our analysis, we compare three case studies of ecosystems facilitating the implementation of organic or agroecological Participatory Guarantee Systems (PGS). PGS are defined as "*locally focused quality assurance systems. They certify producers based on active participation of stakeholders and are built on a foundation of trust, social networks and knowledge exchange*."(IFOAM, 2008). Unlike many other service ecosystems (in health or energy sector), PGS are territorialized, fostering proximity and familiarity among actors. They generate economic, social (through improving farmers' income, their health, as well as consumer's health), and environmental value (by lowering the negative impact of agriculture on environment), making implementation of a common vision easier. Value capture is distinct from business ecosystems with probably less competition between members for value capture. PGS involve technological (new farming systems), organizational (new value chains and new

input suppliers for organic inputs), and institutional (creation of the label) innovations, posing challenges for both evaluation and management. Collaboration is essential due to the diverse skills and functions required for success which are almost impossible to find in a unique actor (Malherbe & Tellier, 2023).

We will briefly introduce the three case studies here, as a more detailed chronology and presentation will be held in the results section, developed from data collection. The first case study refers to the creation and implementation of the organic PGS label in Burkina Faso. Initiated by a coalition of NGOs, local associations, and government agencies in the early 2010s, the organic PGS label implementation is considered advanced. It involves various stakeholders such as local associations (in charge of the production, commercialisation, technical support), farmer organisations, supporting NGOs (technical support and joint activities), projects and donors (technical and financial support), and a private company (in charge of the organic inputs supply and commercialisation). The PGS-standard was issued in 2013 alongside an official law on organic agriculture, with a recognized trademark called BioSPG.

The second case study is the ecosystem of support services supporting the implementation of the organic PGS in Senegal. Commencing in 2015, the support ecosystem for organic PGS in Senegal is also at an advanced stage, focusing on increasing the number of certified producers under the BioSenegal trademark and extending the geographical areas of implementation. Led by an umbrella producers' organization and donor support, it includes local and international NGOs (supporting production and commercialisation), projects and donors (technical and financial support), private organizations (commercialisation), and farmer representatives. The first PGS-standard was released in 2019, followed by the national organic agriculture law in 2020.

The third case study describes the emerging agro-ecological PGS in Madagascar which started in 2018 and is still in its emergent phase, led by an umbrella producers' organization and an international NGO. It involves farmer organizations, training centres (training and support to production), an international NGO (financing and technical support), projects and donors (technical and financial support). A draft version of the PGS-Standard is being tested while the national agricultural organic law recognizing the concept of PGS was disclosed in 2020, a trademark exists but remains underutilized.

4. RESULTS

We will here present the main findings of this article: taking a dynamic perspective, we present the process of emergence of Innovation Support Services Ecosystems (ISSE) related to Participatory Guarantee System (PGS). Emergence has been divided into three different steps (cf

Figure 3): preliminary stages, initiation of the ISSE and scale up. A static view will be taken for each step describing actors, activities, roles, and links, as well as coordination mechanisms implemented by the hub organisation, factors constraining alignment and how the different layers influence each other (cf

Figure 4).

Chronologies of our three case studies have been established and can be found in the appendices (Appendix A, Appendix B and Appendix C) describing ISSE's actors and their activities in relation with evolution of the context and the innovation journey of PGS. Main patterns have been identified and summarised in

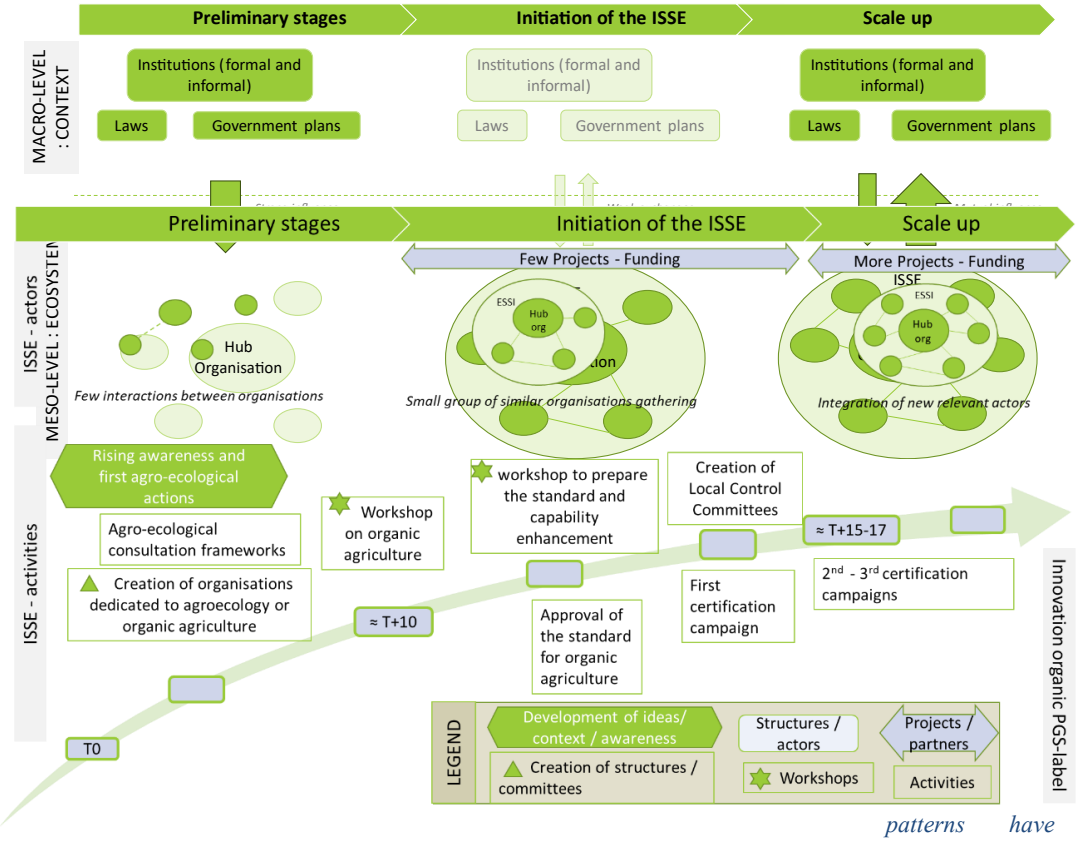

Figure 3.

Figure 3 : Synthetic chronology of the emergence of an Innovation Support Services Ecosystem supporting design, development, and scaling of a new label for organic agriculture in Sub-Saharan Africa (the PGS)

Figure 4 : Levels where the main activities and influence take place according to the three stages of emergence of an Innovation Support Services Ecosystem

4.1. PHASE 1: PRELIMINARY STAGES

The first phase corresponds to a period of continuous improvement of the context until being favourable enough for the emergence of the ISSE. It is the longest one, its duration is extremely variable depending on countries (30 years in Burkina Faso and Madagascar, a decade in Senegal), but also on what interviewed actors consider to be important to create a favourable context for the emergence of the ISSE and how far they go in history. Favourable context is related to the institutional framework (the government organising workshops on organic agriculture, government plans to develop organic or agroecological agriculture, etc.), awareness-rising (on the impacts of pesticides on health and the environment). Another factor is the creation and implementation in the country of new organisations dedicated to organic or agroecological agriculture (NGOs, civil society movements, etc.) and of projects dedicated to farmers' capability enhancement as indicated by an interviewee "*the fact that we started with the grassroot organisation and not with the PGS, it cleared the ground. Because the associative life was not to build, it was already done with the grassroot organisation, the producer organisation*" (MAD_PO2).

During this period, there are often some failures in attempts to create ISSEs, which are important favourable background to ground new initiatives as one of the interviewees told us: "*Through this [consultation] framework, there was already structure in place: some agroecological associations already knowing each other in the field, who developed collaborative relationships on agroecological question. It really was a strong achievement for*

creating the CNABio. Because, you know, when the CNABio was created, we relied on what existed: these people who knew each other a little bit" (BF_NatNGO) and "*Via this framework, a lot of us knew each other, had already developed relationships, collaborations. So, we were rather familiar, we were kind of ready to set off on a new adventure*" (BF_NatNGO).

As illustrated in

Figure 4, the main activities are conducted at macro-level and in this phase, the context has a huge influence on the emerging ecosystem. Context is favourable with awareness rising and organisation of organic agriculture workshops by public authorities.

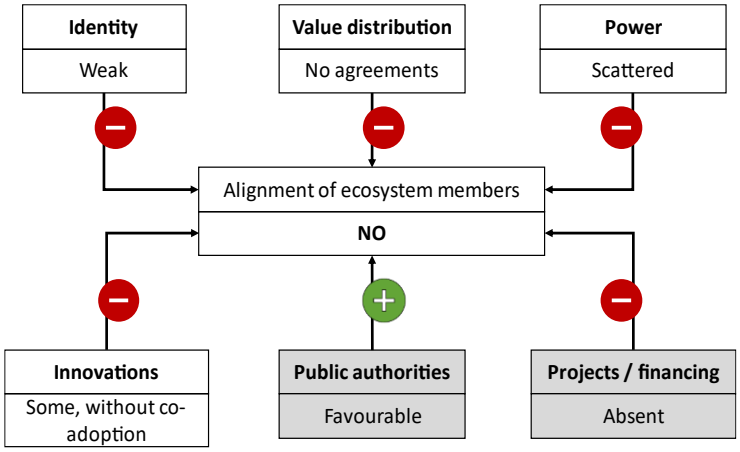

Figure 5 : Effects of the six key alignment factors on ISSE emergence in preliminary stages.
Source: authors, adapted from Malherbe et al 2023
In white, the meso-level factors constraining alignment and in grey, the constraining factors at macro-level.

However, alignment is not yet possible because the other constraining factors are not favourable (Figure 5): identity is weak, there is no agreement on value distribution, power is scattered, innovation level is low and without co-adoption and projects and financing are absent.

4.2. PHASE 2: INITIATION OF THE ISSE

The second phase, "Initiation of the ISSE", broadly represents the period when actors gather and organise themselves. During this phase, the main actors of the ISSE meet regularly, during workshops but also in smaller groups to structure the initiative, to agree on a vision and operational modes. These meetings are considered crucial by the actors we interviewed, to better understand each other and create trust among members of the ISSE; and actors feel they are missing when they are too scarce: "*We need more times when we can discuss together, more moments of interaction and sharing*" (SEN_Cons). In our case studies, it is also during this

period that several documents are designed and validated: i) the standard of PGS for organic or agroecological farming, ii) certification guidelines, iii) the national standard of organic or agroecological farming, iv) control documents, v) the articles and rules of procedure of the association, vi) the logo for the trademark. These objects are crucial for the implementation of the PGS, to explicit what will be allowed or not, who will control that the rules are followed, what will happen if they are not, etc. But beyond this, elaborating these objects together allows members of the ecosystem to spend time together, learn to know each other, develop informal relationships, clarify each other's vision, create mutual trust, etc. Many things that will be of paramount importance afterwards, to deal with the tensions and discords which will no doubt arise.

During this phase, activities are mostly undertaken at meso-level (the ecosystem-level, cf

Figure 4) and there are few interactions with the macro-level. Constraining factors from the environment (public authorities and projects and financing) are globally favourable but with little concrete actions and low level of financing (cf Figure 6). On the contrary, at meso-level, factors are favourable to alignment: agreements are found on most aspects of value distribution, power is partly shared, there are multiple innovations with co-adoption (organic inputs developed by private firms and organic agriculture practices identified in research centres are promoted by NGOs and farmer organisations to the farmers they support, new value chains proposed by traders are adopted by farmers, etc.). The last factor, identity, is developing around a

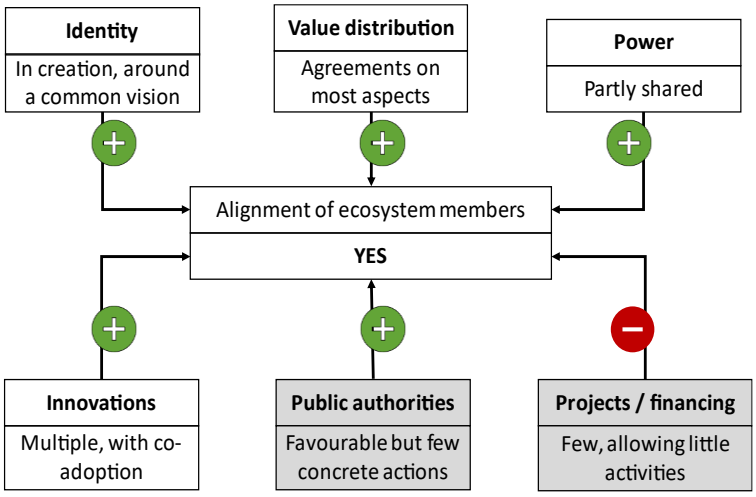

Figure 6 : Effects of the six key alignment factors on ISSE emergence in the phase of initiation of the ISSE

Source: authors, adapted from Malherbe et al 2023

In white, the meso-level factors constraining alignment and in grey, the constraining factors at macro-level.

common vision: after enhancing farmer's technical capabilities, organisations supporting development of organic agriculture or agroecology decide to focus on commercialisation and make distinction with conventional agricultural products to better value agroecological or organic products, thus improving income of farmers. One interviewee clearly cited this shared vision as a factor of success for the emergence of the ecosystem: "*If we want to succeed in that process, all members must have a shared vision to really get to a success in the PGS functioning. And this vision was really centred on improving living conditions of the producers, contributing to develop agroecological production*" (BF_Asso1). On the contrary, in Madagascar, a divergence in the vision was evoked as a reason for not including one actor in the ISSE: "*there are also actors which understands [agroecology] as a transition towards organic agriculture. We hear Symabio say, when we talk with them "oh yes, you are a bit like the pool for organic, you prepare the nursery of organic producers". But it's not like that, the understanding is not yet the same*" (MAD_PO2).

Until now, we presented the converging elements of our three case studies but, this phase is also the moment where we can detect different ways of implementing ISSEs according to the nature of the hub organisation. We observe two scenarii: in Burkina Faso, the hub organisation is a national NGO which gathered a small group of national and international NGOs to initiate the ISSE whereas in Senegal and Madagascar, the hub organisation is an umbrella farmer organisation which developed the PGS more internally with their farmers before making it available to other actors. In the first scenario (Figure 7), the NGOs knew each other, they already worked together (in consortium for projects, or on specific activities according to their area of expertise), they

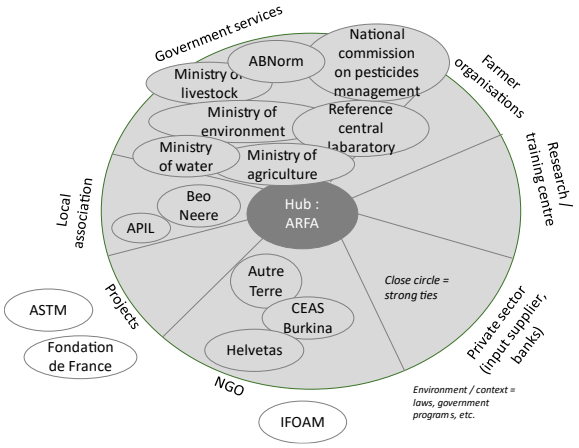

Figure 7: Representation of the ISSE supporting organic PGS in Burkina Faso in initiation phase (2011-2015)

trusted each other which facilitated interactions and exchange of ideas. Quite rapidly, they involved donors they already worked with, to support the implementation of the PGS and were in contact with IFOAM (the international membership-based organisation promoting sustainable agriculture and PGS around the world).

In the second scenario, in Senegal (Figure 8) and Madagascar (Figure 9), the umbrella organisation usually doesn't have counterparts in the country, in the sense that there is no other organisation, working in the same way, with the same objectives and with which they could easily work (without problems of communication, of corporate culture, etc.). These organisations usually have one historical technical and financial partner (HEKS-EPER in Senegal and FERT in Madagascar) supporting them in the implementation of PGS. In Madagascar, the umbrella organisation FIFATA also have strong relationships with organisations that it previously engendered to fill gaps in supporting farmers (an experimentation centre, a service of technical support and expertise for farmers). The PGS-standard is engineered and prepared mainly consulting farmers, their expectations, and the rules that they can comply with, while collaboration with other actors principally consists in keeping them informed of the evolution of the process. An interviewee explained that other organizations were: "*More or less [involved in the creation of the PGS], because, I would say that essentially, the initiative was*

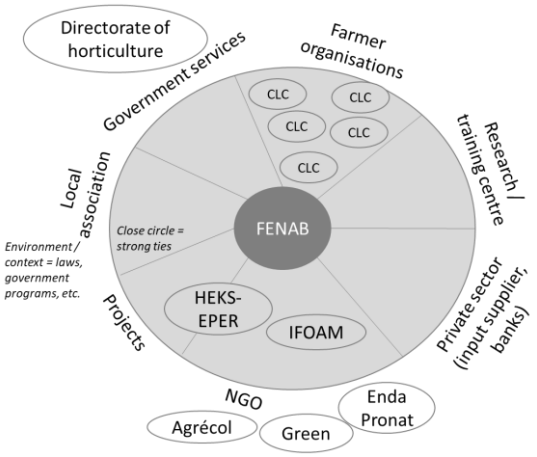

Figure 8: Representation of the ISSE supporting organic PGS in Senegal in initiation phase (2015-2021)

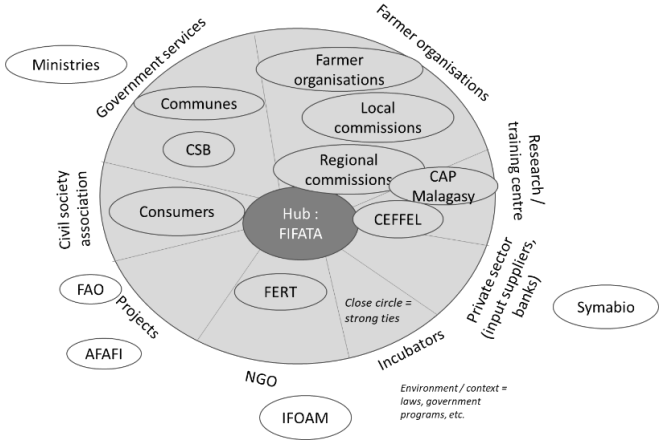

Figure 9: Representation of the ISSE supporting agroecological PGS in Madagascar in initiation phase (2017-2024)

carried out by the FENAB, so they were essentially [involved] through activities and projects"

(SEN_PO2)

4.3. PHASE 3: SCALE UP

The third phase is a scaling up phase which was observable only in the Burkina Faso and Senegal case studies (in Madagascar, the process is still in the initiation phase). During this period and after consolidating the structure and operational modes of the ISSE, the actors are ready to enrich the ecosystem with new members. They also intensify their level of activities, increasing the number of certified farmers and the geographical area they cover. This is possible because their structuration and the previous projects that they had are important guarantees for international donors and development projects allowing for new projects and funding. In this phase, the ecosystem increases its relations with its environment and even starts to influence it (cf

Figure 4).

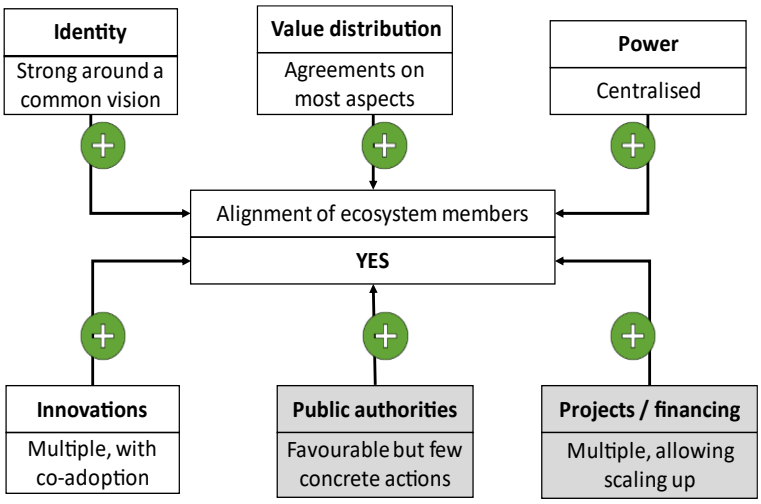

Figure 10 : Effects of the six key alignment factors on ISSE emergence in the phase of scaling up the ISSE

Source: authors, adapted from Malherbe et al 2023

In white, the meso-level factors constraining alignment and in grey, the constraining factors at macro-level.

As one might visualise in Figure 10, in this phase, all alignment factors coalesce. The identity of the ecosystem is stabilised around a common vision allowing to communicate more clearly toward potential new entrants. Power is more centralised than in the previous phase, which is related to the institutionalisation process that the ecosystem encountered (in general taking the form of a formal association). Level of innovation remains high with multiple co-adoption. Influence of public authorities is

still favourable but with few concrete actions as one interviewee stated: "*they don't really have concrete actions to support the sector. Regarding subsidies for example, I think it is largely left behind, compared to what the government pays for conventional farming. So, on the one hand, yes, what government says is rather favourable, but what government does, it's different*" (SEN_Don). The most important difference with previous phase, regarding alignment, comes from the multiple projects and financing, which allow more activities to be undertaken, more farmers to be supported, in more regions of the country and can also motivate new entrants.

The difference observed in the second phase between ecosystems whose hub organisation is an NGO (Figure 11) and those whose hub organisation is an umbrella of farmer organisations (Figure 12), is still visible in the scaling-up phase. As a respondent from the umbrella farmer organisation told us, they decided to open the ecosystem to new entrants when the functioning is considered as structured enough: "*results from this self-evaluation brought to light that it was appropriate to open at national level because Fenab being a national umbrella organisation, there were other organisations requiring [to enter], and now we considered necessary to open to these new organisations*" (SEN_PO2). In parallel, organisations whose implication was low in the

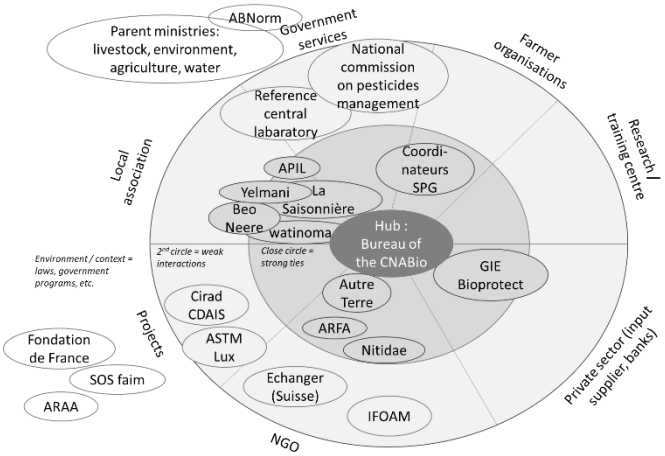

Figure 12: Representation of the ISSE supporting organic PGS in Burkina Faso in scale-up phase (2016-2024)

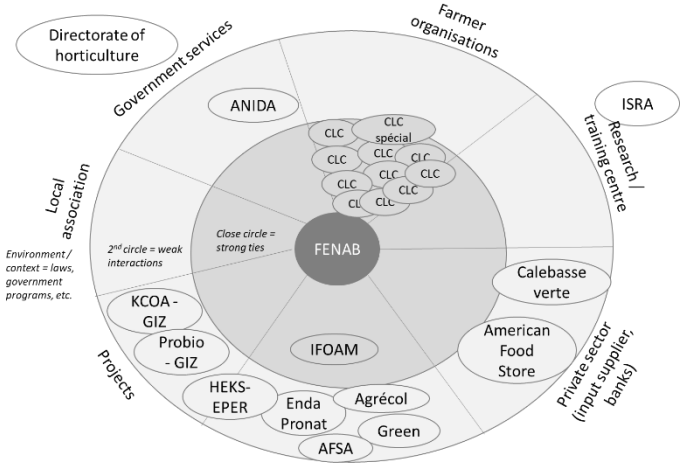

Figure 11: Representation of the ISSE supporting organic PGS in Senegal in scale-up phase (2022-2024)

previous phase decided to comply to the PGS as created by the umbrella organisation and align with it: "*a lot of organisations said "no, that is too radical for us, we don't want that". Now…Well, slowly, I have the feeling that these organisations and more farmers agree to what Fenab proposes and align to this system*" (SEN-Don) and "*even if these organisations had organic labels of their own. But it was not formal PGS […]. But finally, they said that, as the Fenab's one was more harmonised, more structured, that it would be a problem for them to affiliate with the PGS, for a project of national harmonisation of the PGS*" (SEN_PO2).

5. DISCUSSION

The boundaries of a service ecosystem are subjective, as highlighted by Lusch et al (2016), emphasising the researcher's responsibility in defining them according to the analysis objectives. While acknowledging the potential for debate over our chosen boundaries, we deemed them most pertinent for our study. We will here discuss our main results: our analysis primarily centres on the three stages of service ecosystem emergence supporting PGS development. Additionally, we examine the limitations of alignment theory in characterizing our study object and discuss how boundary object theory helps in conceptualizing the two identified drivers.

5.1. DISCUSSING THE THREE STAGES OF ISSE EMERGENCE

In the theoretical framework, we exposed that research on ecosystem emergence failed to consider the preconditions necessary for emergence. In our analysis, we chose to present them as a full-blown stage of the emergence of the ecosystem because, to be able to support the emergence of this kind of ecosystem, it is crucial to identify the precursors needed to make the context favourable. While we could consider that this first phase is quite a static one, when actors wait for the context to become favourable by itself, our results show that two different phenomena coexist: first, the future members of the becoming ecosystem are starting to develop relationships and trust through different activities external to the ecosystem (which will be key

for the second phase of emergence); and second, the conditioning forces (Möller et al., 2020) are progressively becoming more favourable, by means of external actors or of the future members of the ecosystem. In our analysis we considered the interactions between two layers (cf

Figure 4): the Innovation Support Service Ecosystem's and its environment. It is in line with the layers proposed by Möller et al (2020), corresponding respectively to the focal ecosystem (lower meso-layer) and the business field (upper meso-layer). While this framework considers four layers (the two that we just presented plus a macro-layer and a micro-layer), we focused only on these two meso-layers in this study. We overlooked the macro-layer because the evolution of technological paradigms, of the political and economic global, regional, and national context that it encompasses, didn't seem to be the most relevant aspects to consider. The micro-layer, on the other hand, is interesting to consider but our research design would not allow us to study it. We propose that future research deepen this aspect by trying to understand the capabilities needed by the organisations to belong to and make a service ecosystem emerge. During the second phase of service ecosystem emergence, actors gather around a common objective, they develop a common vision, they start to collaborate, exchange resources (financial, human but also knowledge-based) (Thomas et al., 2022), state the functioning rules (Koskela-Huotari et al., 2016), "*design and implement coordination mechanisms that [will] overcome the tensions that exist throughout the project*" (Picaud-Bello et al., 2022). This development of the social capital of the ecosystem is only possible because of the trust built during phase 1. Even though the ecosystem is meant to remain dynamic (Frow et al., 2019), this is also the time when the institutionalisation begins and as Lusch et al (2016) mentioned "*evolution toward at least some stability is part of an institutionalization process in which rules are developed and shared and become a vital coordination mechanism*". Structuration of ecosystems is not compulsory but a possible consequence of coordinated action enabling or constraining the behaviour of actors (Taillard et al., 2016). In this phase, we identified both influences from the ecosystem on its environment and from the environment on the ecosystem which conforms with Möller et al's (2020) statement "*The upper layers influence and condition*

the activities, choices, and contents of the lower ones; and correspondingly the actors, ecosystems and institutions of the lower layers construct and constitute the upper ones". During this phase, the orchestrator (our hub organization) plays a significant role as it is responsible for identifying resources, negotiating the value proposition according to the commonly accepted vision, identifying participants roles and motivating them with the possible benefits they would gain in engaging in the ecosystem (Möller et al., 2020; Thomas et al., 2022).

The third phase that we identified correspond to the second expansion stage of Thomas et al (2022) with a rapid growth, the entrance of new organisations gain of external legitimacy. Similarities are also found with Möller et al's (2020) stabilization phase presenting an ecosystem consolidating, expanding, and further institutionalizing with attempts to influencing regulatory bodies.

Finally, the last stage identified by Thomas et al (2022) was not found in our case studies. This stage is defined as "*successful orchestrators achieving dominance*" and relates to business ecosystems where orchestrators aim at dominating the ecosystem to capture value and gain legitimacy. In the case of the Innovation Support Services Ecosystems that we considered, either the Hub organisation has no willing to dominate the ecosystem or this stage has not yet been reached.

5.2. MERITS AND LIMITS OF THE ALIGNMENT PERSPECTIVE TO STUDY ISSE EMERGENCE

Alignment theory examines how hub orchestration unites diverse members around a shared goal and value proposition by assessing internal and external constraints. However, as outlined in our theoretical framework, adjustments are necessary as this theory originated from business ecosystems in the North, a rather different context than the one we are studying. To refine it for our study, we introduced a new factor: donors and project funding. This helped elucidate the three observed emergence phases: initial lack of alignment, gradual alignment, and optimal alignment with additional funding to improve ecosystem functioning and extend its activities.

Nonetheless, our findings revealed a discrepancy between NGO-initiated and umbrella farmer organization-initiated ecosystems not fully explained by the constraining factors of alignment that we considered.

Two distinct emergence models were observed: in Burkina Faso, NGOs with established collaboration initiated an ISSE characterized by strong relationships from the beginning, collective decision-making, and co-construction of the organic standard, etc. Conversely, the other two case studies featured ISSEs initiated predominantly by umbrella producer organizations. This aligns with research highlighting the pivotal role of Farmer Organizations in AIS and addressing Grand Challenges (Callagher et al., 2022). The divergence in governance approaches was evident from the outset of ecosystem emergence, known to significantly influence further development (Thomas et al., 2022). Early-phase communication is crucial, as it fosters shared intentions which are the core of the ecosystem: actors understand the opportunities and constraints, they influence the interactions between members and are influenced by them (Bratman, 2013; Sawyer, 2005; Taillard et al., 2016). However, this aspect was lacking in ecosystems initiated by umbrella farmer organizations.

In Burkina Faso, the ISSE implementation demonstrated greater inclusivity compared to Senegal and Madagascar, with diverse organizations participating from the outset. However, in the latter two cases, collaboration challenges arose due to a lack of willingness and motivation. These organizations only engaged with others for financial reasons (HEKS-EPER in Senegal and AFAFI and FERT in Madagascar) or international recognition (from IFOAM), indicating a reluctance to collaborate within their local environment. The level of homophily, or similarity, within ecosystems is crucial for collaboration (Isaac, 2012). While working with similar organizations (high degree of homophily) initially builds trust, engaging with diverse entities brings new insights and resources, enhancing ecosystem robustness (Iansiti & Levien, 2004). Our case studies reveal varying levels of homophily over time, with initial collaboration among

similar organizations to build trust before expanding to include diverse partners. Literature on alliance symmetry underscores the benefits of working with similar organizations, promoting alliance durability (Mione et al., 2020). Symmetry is here defined as firms of similar size, with similar capacities and resources, objectives, experience, and symmetry of power and management in the relationship. In our case, symmetry of corporate culture could be added (which was not relevant in the PSA-Fiat case study of Mione et al (2020)).However, excessive eagerness for symmetry can hinder collaboration, particularly for umbrella farmer organizations where finding symmetrical partners is challenging as there is usually not more than one organic umbrella producer organisation in the country.

Corporate culture can also influence collaboration, with producer organizations often operating in hierarchical structures that may impede engagement with other entities. Additionally, organic and agroecological producer organizations traditionally work independently, without relying on external actors (governmental institutions, national public research), leading to a self-sufficient mindset. Moreover, competition among actors can hinder collaboration. While most member organizations in our ecosystems are non-profit and scattered along the value chains generating a relatively low-competitive environments compared to business ecosystems, competition still arises in some instances. In Madagascar, competition for projects and funding between the hub organization and another prominent actor inhibits collaboration. Similarly, in Senegal, competition arises between the hub organization and two NGOs that have their own organic labels and are unwilling to collaborate. Although studying ecosystems mainly through the lens of coopetition is not relevant, it sheds light on members' behaviour and their decisions to engage in coopetitive relationships. Coopetition involves simultaneous competition and cooperation among "complementors" to create additional value for clients(Brandenburger & Nalebuff, 1996; Chiambaretto et al., 2019). However, for coopetition to be effective, tensions must be managed, and the risk of opportunism minimized (Chiambaretto et al., 2019; Le Roy

& Czakon, 2016). In our case studies, actors tended to avoid coopetitive relationships either because they didn't perceive the benefits or because they were unsure about managing opportunism risks.

5.3. THE THEORY OF BOUNDARY OBJECTS TO ENLIGHTEN THE PROCESS OF CO-CREATION OF A COMMON VISION AND ARTEFACTS

Two drivers have appeared particularly important in the emergence and coordination of Innovation Support Services Ecosystems: the co-creation of a common vision and the development of diverse artifacts. This is in line with findings on service ecosystems in tourism destinations where "*the creation of artifacts (formal documents informing the common vision and guiding principles) developed by a public sector organization facilitate collective decision-making and overcome competitive tensions within private organizations*" (Picaud-Bello et al., 2022).

The concept of boundary objects developed by Star & Griesemer (1989) can bring light on how these drivers contribute to ecosystem emergence. A boundary object is defined as ''*an entity shared by several different communities but viewed or used differently by each of them, being both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites*''. They can be either abstract (ideas, concepts, etc.) and concrete (documents, written rules, etc.) objects, aiming at making actors from different worlds, different cultures, different perspectives, work together. To reach this goal, they have the particularity of both having a common enough structure for every stakeholder to understand it and, being malleable enough to allow each stakeholder to adapt it to its constraints (Klerkx et al., 2012; Toffolini et al., 2021).

The organizations involved in our study represent diverse social spheres, including development NGOs, private businesses, donors, research institutions, and public authorities. Each of these entities brings its own perspectives, norms, practices, and timelines, which can

sometimes lead to conflicts. For instance, NGOs focused on supporting farmers in organic agriculture may prioritize cost reduction for farmers, while private companies developing organic inputs need to maintain profitability by pricing their products competitively and won't agree to give their away recipes for inputs to be produced on-farm by farmers. Similarly, development projects and donors often require measurable outcomes within strict timeframes, whereas farmer organizations may advocate for longer-term approaches to expect paradigm changes for farmers. To navigate these potential tensions, boundary objects serve as a means to materialize ideas, consolidate shared knowledge, and facilitate improved communication within ecosystems (Tisenkopfs et al., 2015).

The ecosystem vision serves as an abstract boundary object, which can take tangible form when documented, such as in the rules of association. This vision acts as a crucial orchestrating tool, enabling a hub organization to unite diverse entities around common goals and objectives (Dagnino et al., 2016; Möller & Halinen, 2017; Müller-Seitz, 2012; Murray et al., 2022; Nenonen et al., 2018; Nordin et al., 2018; Reypens et al., 2021). Here, we understand vision in its broad sense, also called agenda-setting and including sense-making and goal-setting (Hurmelinna-Laukkanen et al., 2022). Developing this vision has several benefits for the ecosystem: first and foremost, it clarifies what stakeholders have in common and where they want to go together (Malherbe & Tellier, 2023). As Klerkx et al (2012) mentioned, is also has "*a guiding, convincing, binding, and uncertainty mitigating function*". Besides, it is an important communication tool to attract new members through what authors call the "shared organization myth" summarizing the vision, objectives, governance and commonly accepted rules (Andrieu et al., 2019). Moreover, the ecosystem vision forms the basis of the ecosystem's value proposition, essential for its internal and external legitimacy (Jacobides et al., 2018; Thomas et al., 2022). However, developing the vision is a collective effort, requiring ongoing dialogue and collaboration among ecosystem members (Picaud-Bello et al., 2022). Apart from

building the ecosystem vision, these meetings are important for members to learn about each other, to bind and develop their relationships. Additionally, artifacts created during the initiation phase, such as organic standards, guidelines, and logos, serve a similar purpose, aligning organizations and facilitating early-stage relationships.

However, one aspect of boundary objects must be kept in mind: the flexibility of interpretation characterizing them can lead to misunderstandings on certain aspects while actors have the feeling they are totally aligned (Jakku & Thorburn, 2010). For example, in the organic PGS standard in Burkina Faso, actors agreed on the article 3.3.1: "*The operator must avoid using chemicals which can harm human health or the environment*". For some actors it probably means that all chemicals are forbidden while for others it might allow chemicals that are supposed to be unharmful or if circumstances require.

Thus, boundary objects are an interesting conceptual tool to understand how actors (mis)-understand each other while gathering in a service ecosystem and we propose to amend our conceptual framework accordingly.

6. CONCLUSION

This article contributes theoretically and empirically by enhancing understanding of service ecosystems' emergence, particularly in contexts where national agricultural innovation systems are not fully developed. It identifies the preconditions, drivers, and models of emergence, emphasizing the pivotal role of the hub organization in this process. The research underscores the significance of creating a conducive environment for ecosystem emergence, including the presence of collaborating actors, available funding, supportive legal frameworks, external legitimacy of the hub organization, etc. When these conditions are in place, a small group of organisations can gather and start collaborating before scaling up the initiative (both the PGS-label and the supporting service ecosystem). Furthermore, the study highlights how the nature and actions of the orchestrator profoundly influence emergence and governance within the

ecosystem. It proposes enriching alignment theory by considering coopetitive behaviours between organizations to understand success or failure of emergence and the use of boundary objects to facilitate communication across different social worlds.

From a managerial perspective, the research offers insights for various stakeholders. Governments, donors, and development projects can support necessary preconditions to enable ecosystem emergence. Practitioners should pay attention to specific points depending on the emergence model they are pursuing and recognize the importance of vision and artifacts in the emergence process. However, it's important to note that while certain objects may serve as boundary objects, others may not, depending on their development (for example, an organic PGS-standard developed in silo by one organisation or by similar organisations like in Madagascar, cannot be considered a boundary object).

Despite the credibility and confirmability of the research, its generalizability may be limited due to the small number of case studies. Moreover, our sampling method and difficult access to the field may have limited the representativeness of our sample of stakeholders. Due to the long journey of both innovation and the service ecosystem associated to it, the case studies were analysed retrospectively which can have induced biases and omissions from the interviewees. Replication studies in different sectors and contexts would help validate or refine the findings: replication in the Global South in another sector would allow to verify the constraining factor of projects and donors for alignment; replication with service ecosystems in other contexts would allow to double-check our results on the phases and drivers and models of emergence.

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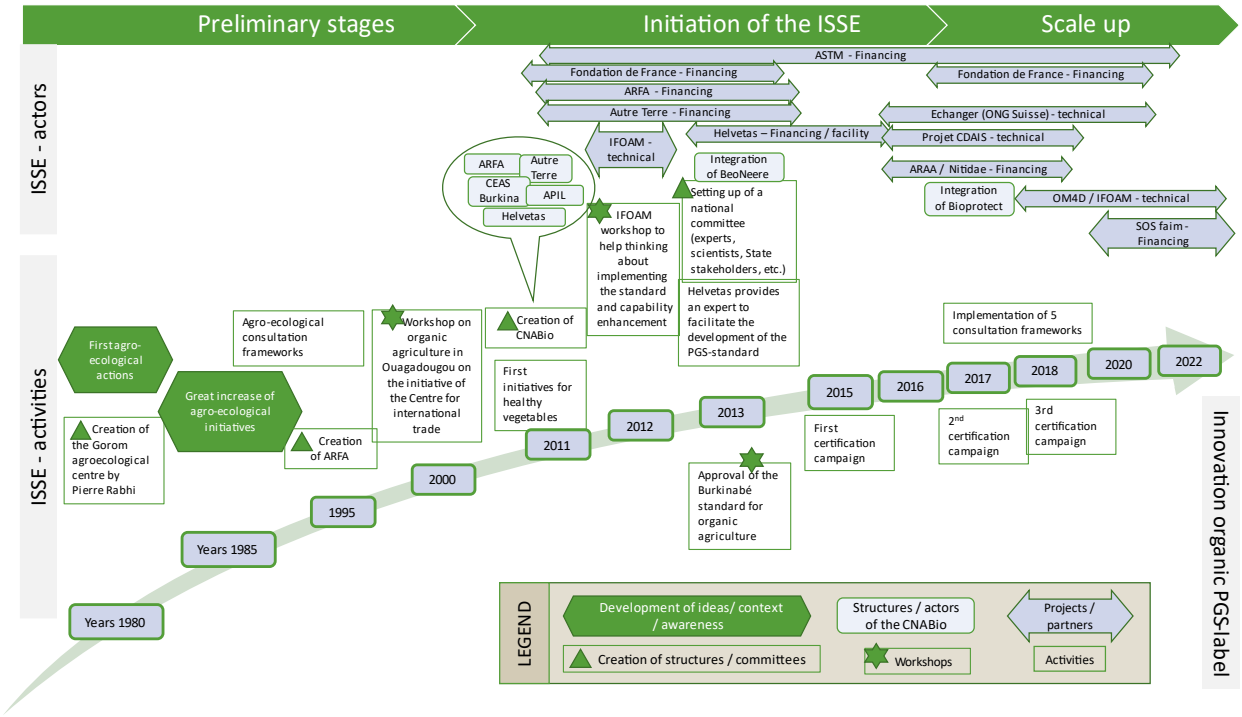
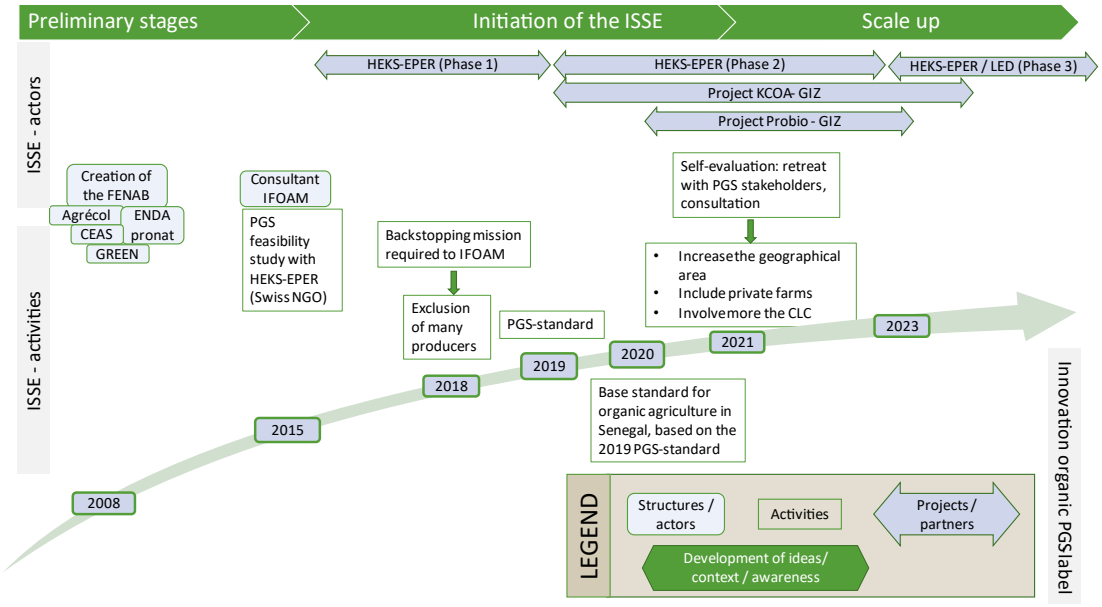
8. APPENDIX

Appendix A. Chronology of the implementation of the Innovation Support Services Ecosystem (ISSE) organic PGS in Burkina Faso



Appendix B. Chronology of the implementation of the Innovation Support Services Ecosystem (ISSE) organic PGS in Senegal



Appendix C. Chronology of the implementation of the Innovation Support Services Ecosystem (ISSE) agroecological PGS in Madagascar